

**WHAT IS CLAIMED IS:**

1. A method for controlling substitute signal transmission in a wavelength division multiplexed (WDM) device having a plurality of sub-bands, each sub-band including at least two signal channels which carry respective data signals, and a plurality of substitute signal transmitters, each substitute signal transmitter generating a substitute signal and corresponding to a respective one of the plurality of sub-bands, comprising:

identifying signal channels having a predetermined characteristic within each of the plurality of sub-bands;

turning on a substitute signal transmitter if the sub-band corresponding to the substitute transmitter includes a predetermined number of signal channels having said predetermined characteristic;

combining the data signals and the substitute signals into a WDM signal; and  
transmitting the WDM signal over an optical transmission fiber.

2. A method according to claim 1, wherein said predetermined characteristic is one or both of unused and inoperable.

3. A method according to claim 1, further comprising:

detecting the wavelengths and power levels of each data signal in the WDM signal.

4. A method according to claim 3, further comprising:

determining if a signal channel has said predetermined characteristic based on the detected wavelengths and power levels of the data signals.

5. A method according to claim 1, further comprising:

adjusting the power of the turned-on substitute transmitter depending on the number of unused or inoperable signal channels in the identified sub-band.

6. A method according to claim 1, wherein said predetermined number is one.

7. A method according to claim 1, further comprising:

detecting a fault in a substitute signal transmitter based on detected wavelengths and power levels of the substitute signals; and

turning on a backup transmitter corresponding to the substitute signal transmitter in which the fault is detected.

8. A method according to claim 7, wherein the number of backup transmitters is less than the number of substitute signal transmitters.

9. A method according to claim 8, wherein each backup transmitter corresponds to a respective pair of substitute signal transmitters.

10. A method according to claim 9, further comprising:

adjusting the power of the backup transmitter based on whether a fault has been detected in one or both of the pair of substitute signal transmitters corresponding to the backup transmitter.

11. A method according to claim 1, further comprising:

determining if there is wavelength drift in a substitute signal output from a substitute signal transmitter based on detected wavelengths and power levels of the substitute signals.

12. A method according to claim 11, further comprising:

adjusting a temperature of the substitute signal transmitter to compensate for the determined wavelength drift.

13. A method according to claim 1, wherein the number of signal channels is at least 128 and the number of sub-bands is no more than 48.

14. A method according to claim 1, further comprising:

attenuating the power of the substitute signals output from each of the substitute signal transmitters.

15. A method according to claim 14, wherein the amount of power attenuated for substitute signals at lower wavelengths is less than the amount of power attenuated for substitute signals at higher wavelengths.

16. A method according to claim 1, wherein said predetermined number is more than two.

17. A method according to claim 1, wherein said predetermined number is determined based on a number of channels in a sub-band.

18. A method for controlling substitute signal transmissions comprising the steps of:  
receiving a command to adjust a power of a substitute signal associated with a particular sub-band, wherein said sub-band includes at least two signal channels; and  
adjusting said power based on said command.

19. A method according to claim 18, further comprising:  
detecting a fault in a substitute signal transmitter based on detected wavelengths and power levels of the substitute signals; and  
turning on a backup transmitter corresponding to the substitute signal transmitter in which the fault is detected.

20. A method according to claim 19, wherein the number of backup transmitters is less than the number of substitute signal transmitters.

21. A method according to claim 20, wherein each backup transmitter corresponds to a respective pair of substitute signal transmitters.

22. A method according to claim 21, further comprising:  
adjusting the power of the backup transmitter based on whether a fault has been detected in one or both of the pair of substitute signal transmitters corresponding to the backup transmitter.

23. A method according to claim 18, further comprising:  
determining if there is wavelength drift in a substitute signal output from a substitute signal transmitter based on detected wavelengths and power levels of the substitute signals.

24. A method according to claim 23, further comprising:  
adjusting a temperature of the substitute signal transmitter to compensate for the determined wavelength drift.

25. A method according to claim 18, wherein the number of signal channels is at least 128 and the number of sub-bands is no more than 48.

26. The method of claim 18, wherein said command to adjust a power is a command to turn said power on.

27. A method of claim 18, wherein said command to adjust a power is a command to turn said power off.

28. The method of claim 18, wherein said command to adjust a power includes a power level value.

29. The method of claim 18, wherein said command is based on a measured power level of said at least two signal channels.

30. A method for populating a sub-band in a wavelength division multiplexing (WDM) system comprising the steps of:

turning on a predetermined number of signal channels in said sub-band; and

turning off a substitute signal, associated with said sub-band, after said predetermined number of signal channels have been turned on.

31. The method of claim 30, wherein said sub-band includes at least 8 signal channels and said predetermined number is greater than 2.

32. A method for switching a sub-band from a service fiber to a protection fiber comprising the steps of:

detecting a problem with a signal channel in said sub-band of said service fiber;

switching all of the signal channels associated with said sub-band of said service fiber to said protection fiber; and

turning on a substitute signal associated with said sub-band of said service fiber.

33. The method of claim 32, wherein said sub-band includes at least two signal channels.

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34. The method of claim 32, further comprising the step of:

turning off a substitute signal for the corresponding sub-band in said service  
fiber.

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